

(19) World Intellectual Property Organization  
International Bureau



(43) International Publication Date  
7 June 2001 (07.06.2001)

PCT

(10) International Publication Number  
**WO 01/41503 A2**

(51) International Patent Classification<sup>7</sup>: **H04R 25/02**

(21) International Application Number: PCT/NL00/00891

(22) International Filing Date: 4 December 2000 (04.12.2000)

(25) Filing Language: Dutch

(26) Publication Language: English

(30) Priority Data:

1013736	3 December 1999 (03.12.1999)	NL
1013949	23 December 1999 (23.12.1999)	NL
1013956	24 December 1999 (24.12.1999)	NL

(71) Applicant and

(72) Inventor: **BORDEWIJK, Lourens, George** [NL/NL];  
Bagijnhof 88, NL-3311 KE Dordrecht (NL).

(74) Agent: **JORRITSMA, Ruurd**; Nederlandsch Octrooi-  
bureau, Scheveningseweg 82, P.O. Box 29720, NL-2502 LS  
The Hague (NL).

(81) Designated States (*national*): AE, AG, AL, AM, AT, AU,  
AZ, BA, BB, BG, BR, BY, BZ, CA, CH, CN, CR, CU, CZ,  
DE, DK, DM, DZ, EE, ES, FI, GB, GD, GE, GH, GM, HR,  
HU, ID, IL, IN, IS, JP, KE, KG, KP, KR, KZ, LC, LK, LR,  
LS, LT, LU, LV, MA, MD, MG, MK, MN, MW, MX, MZ,  
NO, NZ, PL, PT, RO, RU, SD, SE, SG, SI, SK, SL, TJ, TM,  
TR, TT, TZ, UA, UG, US, UZ, VN, YU, ZA, ZW.

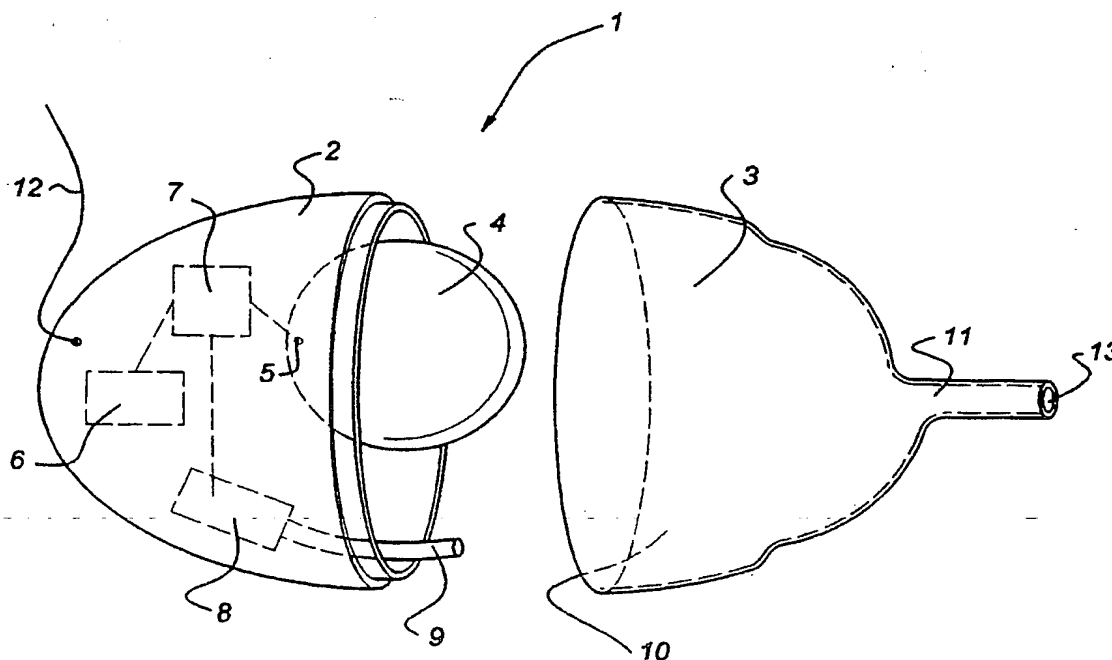
(84) Designated States (*regional*): ARIPO patent (GH, GM,  
KE, LS, MW, MZ, SD, SL, SZ, TZ, UG, ZW), Eurasian  
patent (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European  
patent (AT, BE, CH, CY, DE, DK, ES, FI, FR, GB, GR, IE,  
IT, LU, MC, NL, PT, SE, TR), OAPI patent (BF, BJ, CF,  
CG, CI, CM, GA, GN, GW, ML, MR, NE, SN, TD, TG).

Published:

— Without international search report and to be republished  
upon receipt of that report.

For two-letter codes and other abbreviations, refer to the "Guid-  
ance Notes on Codes and Abbreviations" appearing at the begin-  
ning of each regular issue of the PCT Gazette.

(54) Title: HEARING AID



(57) Abstract: Hearing aid consisting of two parts that can be separated. A chamber for accommodating a battery is delimited between the two parts. The loudspeaker is located some distance away from the sound-emitting opening and the connecting channel between the loudspeaker and the sound-emitting opening comprises the cavity in which the battery is accommodated.

WO 01/41503 A2

Hearing aid

The present invention relates to a hearing aid comprising at least two parts which can be separated and within which a chamber for accommodating a battery is delimited,  
5 provided with a microphone, an amplifier that processes the signal originating from the microphone and a loudspeaker, said loudspeaker being connected via a connecting channel to a sound-emitting opening in said hearing aid.

A hearing aid of this type is generally known in the prior art. With such a hearing aid the loudspeaker is some distance away from the sound-emitting opening and a connecting  
10 channel to the sound-emitting opening from the loudspeaker is required. Aids of this type are in particular intended to be fitted very deeply in the auditory canal, preferably in such a way that no parts are located outside the auditory canal. With this arrangement the problem arises that secretions from the ear permeate the sound conduit and are able to damage the loudspeaker here. Moreover, if the sound conduit is blocked this has an appreciable adverse  
15 effect on the sound quality. Such blockages are particularly difficult to remove and there is a risk that the user will damage the loudspeaker when cleaning the sound conduit. This is one of the reasons why hearing aids of this type which are placed deep in the ear are not yet in general use.

In the prior art it is proposed to fit a filter in the sound-emitting opening. In view of  
20 the size of such hearing aids and the size of the sound conduit it is clear that such filters are particularly small and have a very low capacity. Therefore these filters have to be regularly replaced, which is laborious.

According to another proposal developed in the prior art, a non-return valve is arranged in the sound conduit. Various variants of this are known but practice has shown  
25 that such valves are both vulnerable and unreliable because these become blocked by the secretions from the ear and then no longer function.

The aim of the present invention is to solve the problems indicated in the prior art and to increase the acceptance of hearing aids placed very deep in the ear.

This aim is realised with a hearing aid as described above in that the connecting  
30 channel comprises the chamber for accommodating a battery.

According to the invention the chamber for accommodating a battery also forms part of the connecting channel. This chamber is readily accessible by separating the two parts which make up the hearing aid. The battery chamber itself serves as a buffer for any

secretion that enters the hearing aid from the sound-emitting opening via the channel adjoining the latter. That is to say, the empty space around the battery first has to be filled by secretion before material can possibly reach the loudspeaker of the hearing aid. Such a situation is inconceivable because the functioning of the hearing aid is reduced to such an extent long before that time is reached, so that the user will be forced to clean the various components.

This means that according to the invention the risk of secretion passing beyond the chamber for accommodating the battery is precluded. Moreover, further miniaturisation is possible with the present invention. After all, by using the chamber for accommodating the battery as sound conduit as well, savings can be made in respect of the space for the sound conduit and more particularly in respect of the wall thickness of such a conduit.

More particularly, this construction is advantageous if, viewed in the fitted position, the battery is closer to the eardrum than is the loudspeaker. It has been found that as a result of the shape of the auditory canal such an arrangement is optimum and provides excellent fixing of the hearing aid, whilst, moreover, it is easy to achieve soundproof closure of the auditory canal. After all, the battery is the largest component of a hearing aid.

According to an advantageous embodiment of the invention all electrical components are contained in the one part of the hearing aid and the other part is constructed as a cover in which the sound-emitting opening has also been made. Such a cover can easily be cleaned. Moreover, it is possible according to the invention to construct such a cover as the individualised part, that is to say the part that corresponds to the shape of the auditory canal. The expensive part in which the electronics are located can be constructed as a universal part and, after the exterior of the cover has been shaped to size, a hearing aid matched to the individual requirements can be provided. It will be understood that such an individualisation of the cover is appreciably less expensive than tailoring the part in which the electronic components are present, even apart from the risk of damaging the latter. Optionally such shaping of the cover to size can comprise applying an individualised layer of material acting as a seal. Moreover, markings can be made which individualise such a cover.

According to a further advantageous embodiment of the invention in which the loudspeaker is closer to the outlet of the auditory canal than is the battery, a connecting channel is present between the loudspeaker and the battery in the part in which the

electronic components are present. This connecting channel opens into the chamber for accommodating the battery. According to a further advantageous embodiment, a further connecting channel extends from the chamber for accommodating the battery into the cover, which channel leads to the eardrum. This channel can be integrated with the cover or  
5 can project therefrom.

According to a further advantageous embodiment of the invention the chamber for accommodating the battery is soundproof after closing the base part, in which the electronic components are located, with the cover. Moreover, as already indicated above, the cover provides a seal between the hearing aid and the auditory canal.

10 According to a further advantageous embodiment a pull thread or the like is present by means of which the hearing aid can be removed from the ear.

According to a further advantageous embodiment with which a connecting channel is present between the loudspeaker and the chamber for accommodating the battery, such a sound conduit extends beneath the battery in the use position, that is to say the opening  
15 thereof opens into the chamber for accommodating the battery below the battery.

That part of the cover that provides a connection with the sound-emitting opening can be arranged either centrally or on the top of the cover. This, of course, refers to the use position of the hearing aid.

According to a further advantageous embodiment the connection between  
20 loudspeaker and emission opening is made such that the cross-sectional dimension thereof is essentially constant. This relates both to the surface and to the shape thereof. This also applies in respect of the chamber for accommodating the battery. Therefore, that part of the sound conduit that extends into said accommodation chamber will preferably be above, below or alongside the battery.

25 According to an advantageous embodiment of the invention the chamber for accommodating the battery is acoustically sealed. This is, of course, except for the connection to the loudspeaker and the sound-emitting opening.

The invention will be explained in more detail below with reference to an illustrative embodiment shown in the drawing. In the drawing:

30 Fig. 1 shows the hearing aid according to the invention separated into its parts and partially in cross-section.

In Fig. 1 the hearing aid according to the invention is shown by 1. The hearing aid consists of a base part 2 and a cover 3. Base part 2 is provided with the electronic

components, comprising a microphone 6, an amplifier/processor 7 and loudspeaker 8. Power is supplied by a battery 4 which makes contact with contact 5. Microphone 8 is provided with a flexible sound tube 9. This opens into the chamber for accommodating the battery which is delimited when cover 3 and base part 2 slide over each other. The  
5 accommodating cavity in the cover 3 is indicated by 10. Cover 3 is provided with a flexible sound tube 11 that opens into a sound-emitting opening 13.

12 indicates a removal thread which is made such that on pulling thereon the hearing aid is moved through the user's auditory canal and removed from the auditory canal.

10 It can be seen from the figure that the sound-emitting opening 13 can be placed very close to the user's eardrum. Any secretions originating from the auditory canal are able to pass through flexible sound tube 11 into the chamber for accommodating the battery. However, there is no need to be concerned about passage into flexible sound tube 9. After all, when the chamber for accommodating the battery becomes full, the various components automatically become blocked so that further passage is not possible and the  
15 user is forced, because of the decreasing quality of the sound and possible pressure on the ear, to remove the aid and clean it.

It can be seen from the drawing that this cleaning is particularly simple. After all, by removing the cover 3 the latter can easily be cleaned and there is no risk of damaging the electronic components. Secretions from the ear will essentially be present in the cover 3.

20 It can be seen from the drawing that in the use position the microphone 8 is further away from the eardrum than is the battery 4. In this way the shape of the base part 2 can be optimally adapted to the shape of the auditory canal. After all, such a battery is the largest component in a hearing aid. In this way the shape can be adapted such that the hearing aid does not have the tendency to work its way out of the ear and the part having the largest  
25 dimension can be arranged "downstream" of the condyles of the mandible, so that there is no risk of the hearing aid moving outwards when making chewing movements.

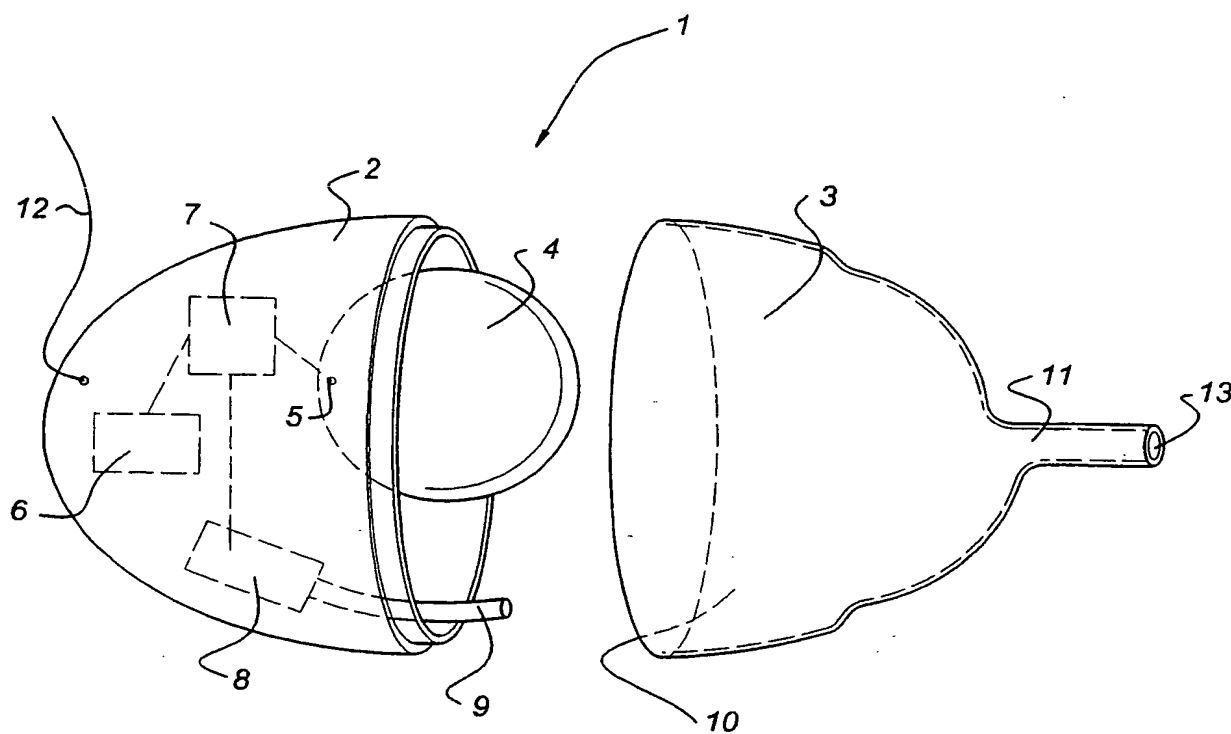
According to an advantageous embodiment of the invention it is optionally possible to incorporate a non-return valve, which prevents secretions moving backwards, in the flexible sound tube 9.

30 Although the invention has been described above with reference to a preferred embodiment, those skilled in the art will immediately be able to conceive variants on reading the above description and such variants are obvious following the above and fall within the scope of the appended claims. For instance, the invention can be employed with

all hearing aids which are at least partially fitted in the ear.

Claims

1. Hearing aid (1) comprising at least two parts (2, 3) which can be separated and within which a chamber for accommodating a battery is delimited, provided with a  
5 microphone (6), an amplifier (7) that processes the signal originating from the microphone and a loudspeaker (8), said loudspeaker being connected via a connecting channel to a sound-emitting opening (13) in said hearing aid, characterised in that the connecting channel comprises the chamber for accommodating a battery.
2. Hearing aid according to Claim 1, wherein said loudspeaker and microphone are  
10 located in the one part (2).
3. Hearing aid according to Claim 2, wherein said one part (2) contains all electrical components and said other part is constructed as a cover (3).
4. Hearing aid according to one of the preceding claims, wherein said connecting  
15 channel comprises a channel (11) extending from the chamber for accommodating the battery to the sound-emitting opening.
5. Hearing aid according to Claim 4, wherein said channel comprises a part (11) in the form of a flexible tube, which is connected to one part of the hearing aid and extends beyond it.
6. Hearing aid according to one of the preceding claims, wherein the connecting  
20 channel comprises a channel (9) extending from the loudspeaker (8) to the battery chamber.
7. Hearing aid according to Claim 6, wherein, when the hearing aid is fitted, said connecting channel extends from the bottom of the chamber for accommodating the battery.
- 25 8. Hearing aid according to Claim 6 or 7, wherein said connecting channel contains a non-return valve.
9. Hearing aid according to one of the preceding claims, wherein said chamber for accommodating the battery is acoustically sealed.





(19) World Intellectual Property Organization  
International Bureau



(43) International Publication Date  
7 June 2001 (07.06.2001)

PCT

(10) International Publication Number  
**WO 01/41503 A3**

(51) International Patent Classification<sup>7</sup>: **H04R 25/02**

(21) International Application Number: PCT/NL00/00891

(22) International Filing Date: 4 December 2000 (04.12.2000)

(25) Filing Language: Dutch

(26) Publication Language: English

(30) Priority Data:

1013736	3 December 1999 (03.12.1999)	NL
1013949	23 December 1999 (23.12.1999)	NL
1013956	24 December 1999 (24.12.1999)	NL

(71) Applicant and

(72) Inventor: **BORDEWIJK, Lourens, George** [NL/NL];  
Bagijnhof 88, NL-3311 KE Dordrecht (NL).

(74) Agent: **JORRITSMA, Ruurd**; Nederlandsch Octrooibureau, Scheveningseweg 82, P.O. Box 29720, NL-2502 LS The Hague (NL).

(81) Designated States (*national*): AE, AG, AL, AM, AT, AU, AZ, BA, BB, BG, BR, BY, BZ, CA, CH, CN, CR, CU, CZ, DE, DK, DM, DZ, EE, ES, FI, GB, GD, GE, GH, GM, HR, HU, ID, IL, IN, IS, JP, KE, KG, KP, KR, KZ, LC, LK, LR, LS, LT, LU, LV, MA, MD, MG, MK, MN, MW, MX, MZ, NO, NZ, PL, PT, RO, RU, SD, SE, SG, SI, SK, SL, TJ, TM, TR, TT, TZ, UA, UG, US, UZ, VN, YU, ZA, ZW.

(84) Designated States (*regional*): ARIPO patent (GH, GM, KE, LS, MW, MZ, SD, SL, SZ, TZ, UG, ZW), Eurasian patent (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European patent (AT, BE, CH, CY, DE, DK, ES, FI, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE, TR), OAPI patent (BF, BJ, CF, CG, CI, CM, GA, GN, GW, ML, MR, NE, SN, TD, TG).

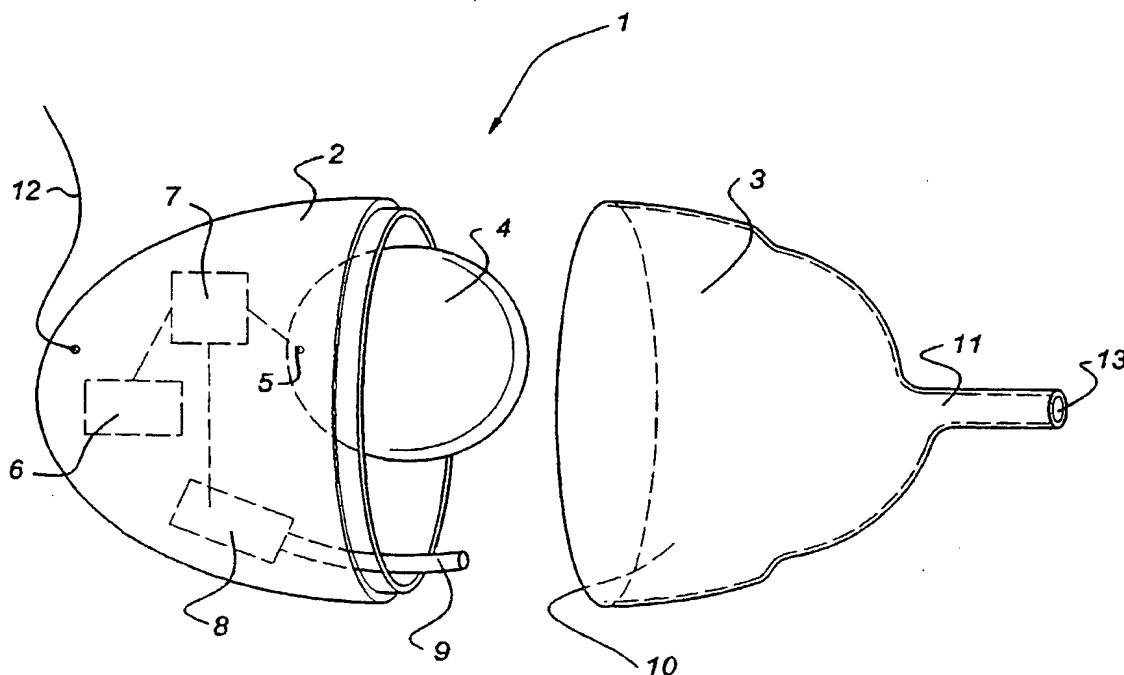
Published:

— with international search report

(88) Date of publication of the international search report:  
17 January 2002

[Continued on next page]

(54) Title: HEARING AID



(57) Abstract: Hearing aid consisting of two parts that can be separated. A chamber for accommodating a battery is delimited between the two parts. The loudspeaker is located some distance away from the sound-emitting opening and the connecting channel between the loudspeaker and the sound-emitting opening comprises the cavity in which the battery is accommodated.

WO 01/41503 A3



*For two-letter codes and other abbreviations, refer to the "Guidance Notes on Codes and Abbreviations" appearing at the beginning of each regular issue of the PCT Gazette.*

## INTERNATIONAL SEARCH REPORT

International Application No.

PCT/NL 00/00891

## A. CLASSIFICATION OF SUBJECT MATTER

IPC 7 H04R25/02

According to International Patent Classification (IPC) or to both national classification and IPC

## B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC 7 H04R

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

EPO-Internal

## C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	WO 99 13686 A (BORDEWIJK LOURENS GEORGE) 18 March 1999 (1999-03-18) page 7, line 32 -page 8, line 32; figures 4,5	1-9
A	US 4 532 649 A (BELLAFIORE GASPARE) 30 July 1985 (1985-07-30) column 3, line 5 -column 4, line 55; figures	1-9
A	DE 85 32 332 U (TOEPHOLM & WESTERMAN APS) ) 3 April 1986 (1986-04-03) claims; figures	1-9

☐ Further documents are listed in the continuation of box C.

Patent family members are listed in annex.

## \* Special categories of cited documents :

- \*A\* document defining the general state of the art which is not considered to be of particular relevance
- \*E\* earlier document but published on or after the international filing date
- \*L\* document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)
- \*O\* document referring to an oral disclosure, use, exhibition or other means
- \*P\* document published prior to the international filing date but later than the priority date claimed

- \*T\* later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
- \*X\* document of particular relevance: the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone
- \*Y\* document of particular relevance: the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art.
- \*&\* document member of the same patent family

Date of the actual completion of the international search

17 August 2001

Date of mailing of the international search report

23/08/2001

Name and mailing address of the ISA

European Patent Office, P.B. 5818 Patentlaan 2  
NL - 2280 HV Rijswijk  
Tel: (+31-70) 340-2040, Tx. 31 651 epo nl.  
Fax: (+31-70) 340-3016

Authorized officer

Gastaldi, G

# INTERNATIONAL SEARCH REPORT

Information on patent family members

Inventor's Application No

PCT/NL 00/00891

Patent document cited in search report		Publication date	Patent family member(s)	Publication date
WO 9913686	A	18-03-1999	AU 9096898 A EP 1031257 A	29-03-1999 30-08-2000
US 4532649	A	30-07-1985	NONE	
DE 8532332	U	03-04-1986	NONE	